DOCUMENT RESUME

ED 264 111 SE 046 271

TITLE	Preparation of Fish Bagoong and Shrimp Bagoong. What We Make. Science and Technology Education in Philippine Society.
INSTITUTION	Philippines Univ., Quezon City. Science Education Center.
SPONS AGENCY	National Science Development Board, Manila (Philippines).
PUB DATE	Apr 82
NOTE	15p.; For other documents in this series see SE 046 255-274.
AVAILABLE FROM	University of the Philippines, Institute for Science and Mathematics Education Development, Pardo de Tavera St., Diliman, Quezon City, Philippines ($1.00).
PUB TYPE	Guides - Classroom Use - Materials (For Learner) (051)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Biochemistry; *Food; Foreign Countries; High Schools; Learning Activities; Nutrition; Science Activities; Science Education; *Secondary School Science
IDENTIFIERS	*Bagoong; Philippines

ABSTRACT

Salted fish paste (locally known as "bagoong") is fermented fish and salt with or without spices or coloring. A bagoong preparation is actually a digestion of fish protein into substances which can be taken in by the body cells and changed into body material. The substance is used in many Filipino dishes (such as pinakbet, dinengdeng, or buylanglang) since it not only adds favor but also is a good low-cost source of protein. This module: (1) briefly describes the fermentation process; (2) discusses the nature of dilis bagoong; and (3) outlines the procedures to make dilis bagoong or alamang bagoong. A self-test (with answers) and glossary of key terms are included. (JN)

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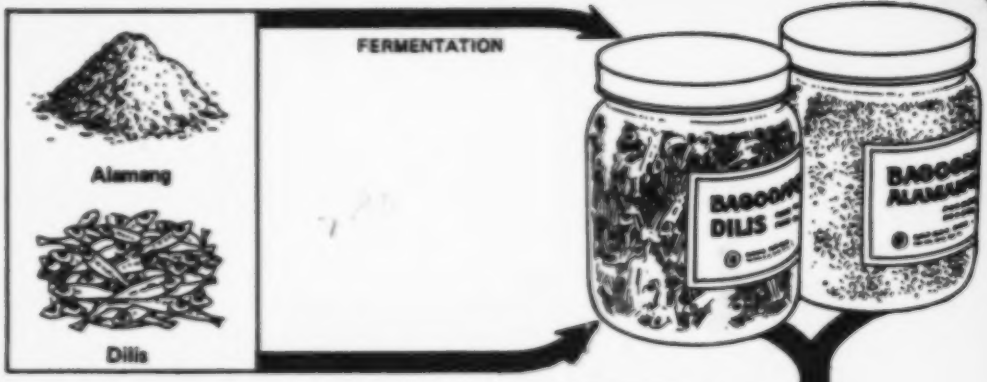

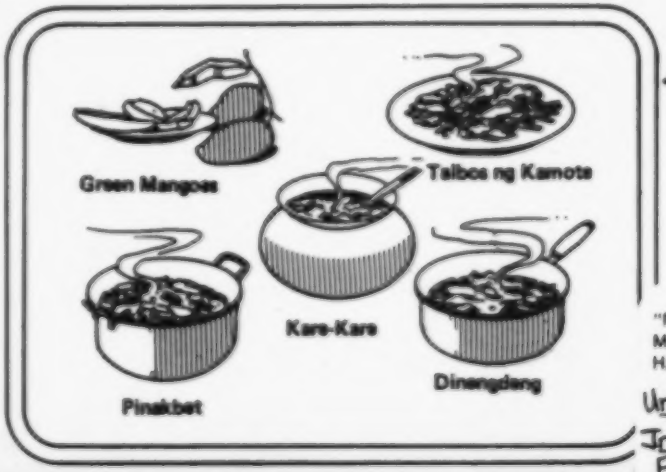

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Preparation of Fish Bagoong & Shrimp Bagoong

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Published and printed by the

SCIENCE EDUCATION CENTER
Vidal A. Tan Hall
University of the Philippines
Diliman, Quezon City

April, 1982

PREPARATION OF FISH BAGOONG AND SHRIMP BAGOONG

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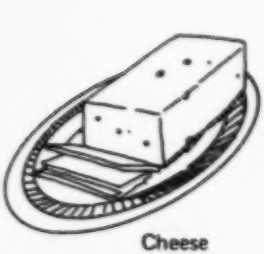
Preparation of Fish Bagoong & Shrimp Bagoong

You have probably enjoyed such Pilipino dishes as ***pinakbet***, ***dinengdeng*** or ***bulanglang*** made tasty with **dilis bagoong**. It not only adds flavor, but also is a good low-cost source of protein.*

Besides protein, ***dilis*** is rich in mineral salts, Vitamins A and niacin.* As a source of protein and minerals ***dilis*** is as good as milk. Its calcium content is more readily used by the animal body than that in milk.

Have you ever asked how ***bagoong*** is prepared? What chemistry happens in its preparation? Would you like to make bagoong for your home use? If you succeed in making good bagoong, buy ***dilis*** and ***alamang*** (small shrimps) when they are plentiful and cheap and earn more money by selling your product to your neighbors.



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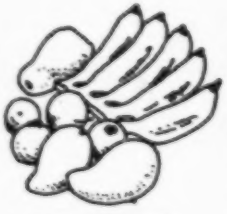


Ripening Fruits

Pickles

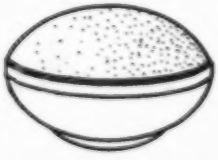
Bagoong

Wine

Vinegar

Patis

Toyo



Rising of Bread Dough

What chemical change is common in the preparation of these products?

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*An asterisk (*) marks each word defined in the glossary at the end of this unit.

FERMENTATION

Bagoong is produced by a process called fermentation. Fermentation refers to the chemical changes in plant and animal matter caused by microorganisms. These microorganisms act on such organic matter as starches, proteins, fats and oils. These materials are broken into simpler substances with changes in taste, smell and color. Actually enzymes or the chemical substances produced by the living cells of microorganisms cause fermentation. Since ancient times, bacteria, yeasts and molds, had been found to cause changes in the preparation of foods, beverages, textiles and leather.

Examples of useful fermentation happen in the making of cheese from milk, the ripening of fruits, the making of wine or vinegar from fruits, the rising of dough in bread making, toyo from soya beans, patis from fish or *alamang*, the digestion of food in the stomach and intestines, the preparation of fish or *alamang* bagoong and vegetable pickles.

But some organisms as putrefaction or decay molds cause harmful changes. Putrefaction causes bad odor or poisons in food. Cold storage, freezing, smoking and other methods like canning or bottling prevent putrefaction. Action of microorganisms is determined by several factors:

1. The right choice of microorganism because the enzyme of each organism acts on specific substances to make specific products.
2. Microorganisms need the right growth substances, carbohydrates and inorganic salts like ammonium compounds and phosphates.
3. Acidity and temperature affect the organism's growth. Each organism lives best in a certain level of acidity and temperature. Too low acidity might cause other organisms to live. Too high acidity might kill the organism. Too high a temperature might also kill the organism.
4. Air affects the organisms. Some organisms need air, others are killed by it.

THE NATURE OF DILIS BAGOONG

Salted fish paste (locally known as *bagoong*) is fermented fish and salt with or without spices* or coloring.

A *bagoong* preparation is actually a digestion of fish protein into substances which can be taken in by the body cells and changed into body material. At first, it was not known whether *bagoong* fermentation is caused by the action of enzymes present in the digestive organs or muscles of the fish or by bacterial action. In 1949, a study by Uyenco, V., *et. al*[4] of the changes in *bagoong* and *patis* showed that proteins are digested by enzymes present in the digestive organs and not by enzymes in muscle tissues nor by the action of microorganisms. In the process, the enzymes of the digestive organs can change the proteins of fish through all the intermediate products of the breakdown to the final product, the amino acids.*

During *bagoong* fermentation, make sure no putrefaction* or decay* occurs due to bacterial action. If the *bagoong* becomes basic instead of acidic due to a

collection of basic products of protein breakdown such as ammonia, then putrefaction has occurred.

According to another report[3] on salted fish paste, salt affects the activity of microorganisms as well as the action of the enzymes present in the fish. The fact that salt is commonly used as a food preservative* suggests that too much salt prevents the action of bacteria and enzymes in any food material. Furthermore, much salt causes a longer time for the fermentation or aging of *bagoong*. At the same time it slows down the formation of a pleasant flavor. A salt-to-fish mixture of 1 part salt to 2 parts fish (1:2 ratio*) or 2 parts salt to 3 parts fish (2:3 ratio) was found as too much salt. Under these ratios, the aging time took from three to six months.

But, a salt-fish mixture with too little salt causes microorganisms to grow and the *bagoong* will undergo putrefaction and have a bad smell. Good ratios of salt-fish mixtures are 1:4, 2:7 or 1:3 from less to more salt. Under these ratios the amount of bacteria in the salt-fish mixture decreases fast, the longer it is left in the mixture.

According to Jose Sulit[3], the length of time of fermentation may be determined by knowing the best temperature and the best acid range for the fermentation of the fish-salt mixture.

Sterilizing* at 60°C kills bacteria but at the same time it stops the activity of enzymes. The ideal temperature range for *bagoong* fermentation is from 37°C to 45°C.

Enzymes are likewise affected by acids and bases. They are more active in an acid range of from pH* 5.4 to pH 6.0.

The Bureau of Foods and Drugs Administration gives the following requirements for *bagoong*:

Total solids	40%
Protein	12.5%
Salt (sodium chloride)	20 to 25%

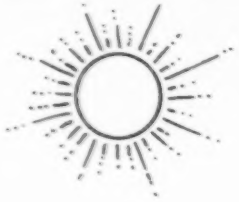
PREPARATION OF DILIS BAGOONG OR ALAMANG BAGOONG

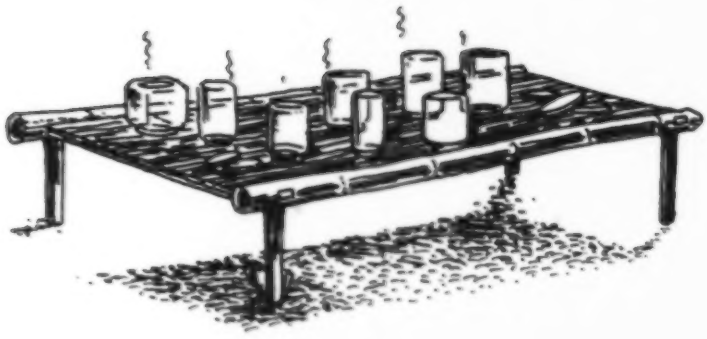
You will need:

- wide-mouthed glass bottles with tight-fitting covers
- soap
- kitchen salt free from calcium and magnesium salts.[1,2] If purified salt is not available use the best kind of kitchen salt.
- fresh *alamang* (small shrimps) or
- fresh fish, small *dilis* or any small fish if *dilis* is not available (Fish should not have breaks in the flesh or head.)
- plastic bowl for mixing fish and salt
- wooden or plastic spoon for mixing
- bamboo or plastic strainer or bilao
- masking tape
- wooden or cardboard box with sand to hold bottles

Follow these steps

1. Record the cost of your raw materials.
2. Wash all the bottles in soapy water. Rinse and dry them in the sun.



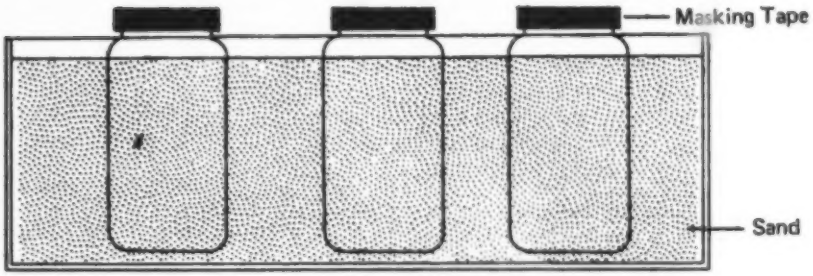


3. Remove pieces of shells, sticks, seaweeds, and other impurities from **unwashed fresh** dilis or ***alamang***. Wash dilis or ***alamang*** in a solution of 3.5 g (1 tsp) of salt in 100 mL (6 tbsp) of water. Do not use sea or stream water that might add microorganisms or fly larvae. Drain the fish using a bamboo or plastic strainer or bilao. Do not use a metal strainer. It discolors the salty fish or ***alamang***.

4. Add purified salt to the fish or *alamang* in the mass ratio of 1:4 or 2:7 or 1:3 depending on how salty you want your bagoong. The following table shows the amount of fish or *alamang* salt for each proportion.

Proportion	Amount of Dilis/Alamang	Amount of Salt
4:1	1 kg ≈ 5 cups/6 1/2 cups	250 g ≈ 1 1/2 cups
7:2	1 kg ≈ 5 cups/6 1/2 cups	286 g ≈ 1 3/4 cups
3:1	1 kg ≈ 5 cups/6 1/2 cups	333 g ≈ 2 cups

Salt free from calcium and magnesium salts causes a fermentation speed of digestion twice as fast as impure salt. Mix well and fill the clean and dry bottles up to the top so that little air is left inside the bottle. Clay jars may be used instead of glass bottles.



5. Replace the bottle stoppers and seal with masking tape. Keep the bottles in a box filled with sand. Keep that part of the bottle with the masking tape above the sand.
6. Place the box in the sun or in a warm place to keep the temperature between 37°C and 45°C. Keep the fish or *alamang* mixture at this temperature for one week. Then keep the mixture for two more weeks at 37°C or in a clean warm place with little movement of air. You may leave the box with the bottles to stand at room temperature.
7. The 3 weeks of storage at these controlled temperatures result in the same degree of fermentation as that of 6 months or more of storage at a lower temperature.
8. It is better to allow the fermentation to proceed for about 6 months. This will bring out a characteristic fish, cheese-like odor caused by the breakdown of fish proteins.

Check Your Product

Your product must be attractive in color, odor, taste, texture, cost and packaging.

1. Check your cost. Compare the cost of your product with an equal amount sold in the market. How much do you gain if you sell your product at the market price?
2. Design an attractive label for your bottle of bagoong. Add a recipe for using the *bagoong*.
3. Use your *bagoong* and also that bought in the market separately in a recipe as follows:
   Bagoong guisado: Saute 4 sections of chopped garlic in 4 tablespoons of oil until golden yellow in color. Add chopped onion and tomato, then 1/2 cup of *bagoong* and stir. Add 2 tablespoons of vinegar or calamansi juice and 1 teaspoon of sugar. Allow to boil.
4. Ask your teacher and the class to compare your uncooked and cooked *bagoong* with the *bagoong* prepared by the other members of your group and the commercial *bagoong*.
   Make a table evaluation like this:

	Color	Odor	Taste	Texture	Cost
Uncooked bagoong (your product)					
Uncooked bagoong (commercial)					

5. Give the salt-fish ratio and length of aging of the bagoong voted best by the class.

Shelf-Life

1. Put some of your *bagoong* in a clean and dry bottle. Fill the bottle up to the top to remove the air.
2. Cover tightly. Write the date on the bottle's label.
3. Look at the unopened bottle every two weeks. Watch it closely for signs of mold or spoilage.
4. After the fermentation period, open the bottle. Test whether the mixture is still acidic using an indicator solution* or litmus paper*. If your test shows the *bagoong* is basic, or smells bad or shows signs of mold, throw away the *bagoong*. Basic products show putrefaction and are harmful.

TEST YOURSELF

1. A market vendor says her dilis is fresh. Which of the following observations show the dilis is fresh?
   a. The dilis has firm flesh.
   b. The dilis has reddish full gills.
   c. The dilis has bright full eyes.
   d. All of the above.

2. If a friend asks you what causes the fermentation of fish in *bagoong*, which of the following statements would be your answer?

   a. The enzyme in bacteria causes changes in the flesh of the fish and, hence, results in fermentation.
   b. The salt breaks the flesh into small parts and results in fermentation.
   c. The enzymes in the digestive organs of fish cause the digestion of the fish protein and results in fermentation.
   d. All of the above.

3. A bottle of *bagoong* was found to be bad smelling and caused litmus paper to change to a blue color. What does this show?

   a. Putrefaction has taken place.
   b. Anerobic bacteria have grown in the *bagoong*.
   c. The *bagoong* has too little salt.
   d. All of the above.

4. If you give your friend instructions on how to prepare *bagoong*, what will you tell her to control?

   a. the amount of salt
   b. the temperature
   c. the acidity
   d. all of the above.

The answers to the test are given after the glossary.

GLOSSARY

amino acids – acids made up of carbon, hydrogen, oxygen and nitrogen. The nitrogen is found in an amino (NH_2) group. The amino acids are the simple building units of proteins. The simplest amino acid is glycine with the formula CH_2NH_2COOH.

decay – decomposition of proteins by aerobic (need air to live) bacteria. The oxidized products of decay have no smell.

indicator solution – an acid-base indicator is a substance that shows a certain color in an acid and another color in a base solution.

litmus paper – a paper soaked in litmus indicator solution and then dried. Litmus paper turns red in an acid and blue in a base solution.

niacin – also known as nicotinic acid is one of the B-vitamins. Niacin prevents pellagra. Pellagra is a disease marked by inflammation of the skin. Niacin also prevents inflammation of the mucous membranes, disorders of the gastro-intestinal tract and of the central nervous system.

pH – symbol used by chemists to indicate whether a solution is neutral, acidic or basic. A solution with a pH of from 1 to 6 is acidic, a pH of 7 is neutral, and a pH of from 8 to 14 is basic.

preservative – a substance added to food to prevent or reduce undesirable changes in it.

protein – one of the substances found in living cells. All proteins are made up of the elements, carbon, hydrogen, oxygen, nitrogen and usually small amount of sulfur. Some proteins contain besides the above mentioned elements, phosphorous, iron, iodine or other elements. It is a food needed by the animal body to build up its own protein.

putrefaction – the rotting or spoiling of animal or vegetable matter usually accompanied by bad smell. Putrefaction is caused by anerobic (can live without oxygen) bacteria. This is incomplete oxidation of organic matter.

ratio – It shows the relationship between two qualities. For example the ratio of salt to fish, 1:3 or 1/3 means that for every part of salt there are 3 parts of fish.

If the word fraction is used instead of ratio. It means the parts out of a whole. The numerator gives the parts and the denominator the whole number of parts. The fraction 1/3 tells us that 1 part is compared to 3, the whole number of parts.

spices – aromatic vegetable products as pepper, ginger, cloves used in cooking to flavor food.

sterilizing – process of freeing a material from microorganisms by killing those present by application of heat.

ANSWERS TO TEST YOURSELF

1. d
2. c
3. d
4. d

REFERENCES

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